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Evaluation of Liver Biochemical Changes among Arc Welders in Enugu Metropolis

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ABSTRACT

Arc welding produces oxide dusts and fumes of Cadmium (Cd), and other heavy metals in the cause of their unregulated activities; and are exposed to these fumes either through inhalation, skin contact or ingestion. This study aims to determine the blood Cd levels and their effects on liver Biomarkers among Arc welders in Enugu. Blood samples were collected from arc welders who were all males (n = 50), with age ranging from 18 - 65 years, also from control group (n = 50) with age range of 18-65 years. 5ml of blood was dispensed into plain tubes for biochemical markers assay respectively. Serum for Biochemical assays was stored frozen at -20°C pending analysis. Analysis was performed using standard methods. Data was analyzed using statistical package for social sciences version 22 and student t-test to compare means between control and study groups. Statistically high levels of serum cadmium and liver makers were seen among exposed participants when compared to the non exposed (control group); Cd [0.0111 ± 0.0046, 0.0074 ± 0.0058; p< 0.05], ALT [18.27 ± 8.8, 16.80 ± 5.9; P< 0.05], AST [23.41 ± 7.6, 19.50 ± 3.4; p< 0.05], ALP [86.92 ± 29.2, 76.90 ± 18.11; p< 0.05]. No relationship between serum cadmium and liver biomakers were observed Cd and ALT (r = 0.112; p=0.450), Cd and AST (r = 0.086; p=0.561), Cd and ALP (r = 0.185; p=0.208). We therefore conclude that exposure to heavy metals like cadmium indicate higher absorption of these metals among welders which directly can impair liver function, Regular monitoring of these heavy metals' levels, liver function tests among occupationally exposed individuals is strongly advocated.

INTRODUCTION

Arc-welding is a process of joining metals with the use of heat, pressure or electric arc. The most common type of welders are arc welders, who carry out the procedure by creating an electric arc that provides the heat required to fuse metals together[4]. Metal vapors produced during this process have the potential to be ingested, absorbed, and circulated throughout the body's systems by the blood. Metal fumes generated may contain heavy metals like iron, chromium, nickel, cadmium manganese etc. Workers could be exposed to metals related to welding through ingestion, inhalation or skin contact. This is crucial for evaluating the risk that welders face because eating or drinking anything might expose them to high concentrations of heavy metals. Large levels of heavy metals in meals have been linked to liver damage, making these channels (ingestion/drinking) crucial. Some research has been undertaken to evaluate the toxicity of welding fumes using both in vitro and in vivo models. It was described that fumes of stainless steel associated with manual metal

arc welding induced higher cytotoxicity on rat macrophages than from fumes generated from other processes of welding [14].

Cadmium (Cd) is a hazardous heavy metal that occurs naturally and is frequently utilized to make materials resistant to corrosion. Nevertheless, it is not necessary nor biodegradable in the human body[8]. Occupational exposure to cadmium can occur during nickel-cadmium battery manufacturing, zinc mining, and arc welding. In addition to exposure at work, cigarette smoking and drinking tainted water or food can also expose one to cadmium in the environment[10]. The human body absorbs cadmium mostly through the respiratory system and subsequently through the gastrointestinal system[5]. On the other hand, cadmium has an exceptionally long biological half-life (about 20–30 years in humans) due to its poor excretion rate[2]. Cadmium's extended half-life might intensify its harm to specific organs, like the liver and kidneys[2]. The effect of cadmium on the kidney is well documented; however, relatively few studies have focused on the liver.

METHODOLOGY

Study design/selection

A cross sectional study that involved a total number of hundred male adult arc welders between the ages of 18 - 65years in Enugu metropolis. The study comprise of fifty adult male arc welders as test subjects and fifty apparently healthy adult male as the control. Informed and written consent is obtained from each participant. Questionnaires were distributed and dully filled by the participants before commencement of the study.

Inclusion criteria

Apparently healthy adult male arc welders between the ages of 18 - 65years from Enugu metropolis.

Exclusion criteria

This study excluded Smokers, females, and Sick people.

Ethical consideration and informed consent

Ethical clearance was duly obtained from the Ethical Review Committee of University of Nigeria, Enugu Campus. Informed and written consent of the study participants was also obtained.

Blood collection/handling

5ml of fasting blood sample was collected from the participants by venipuncture using a sterile needle and syringe with appropriate aseptic technique from the medial cubital vein into appropriately labelled plain vacutainer tubes. The samples were allowed to clot, centrifuged and the serum samples were separated into appropriately labelled serum tubes. They were maintained at refrigeration temperature until analysis within 48hours of collection.

Biochemical analysis

The quantitative determination of Cd, Alanine transaminase (ALT), Aspartate transaminase (AST) & Alkaline Phosphatase(ALP) was done using enzymatic method with the manufacturer's instruction dully followed.

Data Analysis

Statistical analysis of data collected was done using Statistical Package for Social Sciences (SPSS) version 22.0 (IBM Corp, Armonk, NY, USA) and in a descriptive manner, the data obtained was

presented as means and standard deviations. Student t-test was used to calculate differences between group means. The relationships between parameters were obtained using Pearson correlation. p-value < 0.05 was considered statistically significant.

RESULTS AND DISCUSSIONS

Table 1: Comparison of mean and standard deviation of biochemical parameters of occupationally exposed and Non-exposed

Parameters	Mean ± SD Exposed (n=50)	Mean ± SD Non-exposed (n=50)	value
Age (years)	38.23 ± 13.16	38.50 ± 12.80	0.830
ALT (IU/L)	18.27 ± 8.8	16.80 ± 5.9	0.031
AST (IU/L)	23.41 ± 7.6	19.50 ± 3.4	0.040
ALP (IU/L)	86.92 ± 29.2	76.90 ± 18.11	0.021
Cadmium (ppm)	0.0111 ± 0.0046	0.0074 ± 0.0058	0.018

Values are presented as mean ± SD

P< 0.05 is significant

Table 1 shows the mean ± SD of Age, ALT, AST, ALP and Cadmium of occupationally exposed and unexposed. The result shows no statistical significant in age of the group but showed significantly higher levels of ALT, AST, ALP and Cadmium in exposed group when compared to non-exposed. Cd [0.0111 ± 0.0046, 0.0074 ± 0.0058], ALT [18.27 ± 8.8, 16.80 ± 5.9], AST [23.41 ± 7.6, 19.50 ± 3.4], ALP [86.92 ± 29.2, 76.90 ± 18.11], P<0.05.

Table 2: The relationship between cadmium (cd) and liver biomakers in occupationally exposed

Parameters	(r) Pearson	P - values
Cd vs ALT	0.112	0.450
Cd vs AST	0.086	0.561
Cd vs ALP	0.185	0.208

Correlation is significant at P < 0.05

In Table 2: cadmium and liver biomakers were correlated and the result showed no significant correlation between Cd and ALT (r = 0.112; p=0.450), Cd and AST (r = 0.086; p=0.561), Cd and ALP (r = 0.185; p=0.208).

Occupational exposure to welding fumes is a serious occupational health problem all over the world. Welders are exposed to a wide range of potentially toxic metals including Cd. The present study shows high mean value of cadmium among the occupationally exposed than the unexposed which is in line with study done in Jos, which also found high levels of Cd, lead and Cromium in welders and car painters though duration of exposure is limited to the time at work[3]. Since blood Cd levels reflect both recent and long-term exposure, the increase of blood Cd can be observed in workers several weeks after occupational exposure to welding fumes[6]. The rise may be the result of workers' poor hygiene practices—many of them involve eating without washing their hands—or ingestion of heavy metals through inhalation[3]. These results back up the use of public health measures to reduce cadmium exposure and avoid negative health effects.

Also our study showed increase in of serum levels of (ALT, AST, and ALP) when compared to the control group, increase in these enzymes suggest hepatocyte cell membrane damage. Liver plays a

central role in the metabolism and excretion of chemicals which makes it highly susceptible to their adverse and toxic effect[14], previous studies also revealed increase in liver enzymes[3]

Table 2 showed no correlation between cadmium and liver biomakers, which is consistent with some past studies [15,16] . However, few studies indicates positive relationship of Cd and liver enzymes[9,12]. some previous studies reported that high urinary cadmium levels were related to high ALT[11]. Others showed positive relationship between high urinary cadmium and ALP/GGT[12](Gamma-glutamyl transferase) Despite the fact that acute cadmium exposure is known to cause liver damage[17] and serum cadmium is appropriate for diagnosing short-term exposure to cadmium[11], it is not a suitable indicator to assess the severity of an illness[7] because the relatively long half-life of serum cadmium (75 to 128 days) could show false positivity[1].Also the discrepancies could be as a result of sample size, the present study sample size is small compared to other studies.

CONCLUSION

Exposure to heavy metals like cadmium indicate higher absorption of these metals among welders which directly can impair liver function, Regular monitoring of these heavy metals' levels, liver function tests among occupationally exposed individuals is strongly advocated.

Conflict of interest: The authors declare no conflict of interest.

Ethical consideration: Ethical approval was duly obtained from the Ethical Review Committee of University of Nigeria, Enugu Campus.

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